self-driving arrangement, and that the use of a separate motor will remedy these defects. The trials referred to were made with various forms and sizes of siren and several instruments sounded on the reed principle, the result being that the reed instruments proved greatly inferior to the siren instruments in loudness and penetrating power. It is contended by some that the reed principle as applied for the production of loud sounds has never yet been done justice to, and that with proper development a reed instrument could be made to yield sounds as powerful and penetrating as those of the siren; but, as Mr. Price Edwards points out, the reed instruments tried, and which were supposed to be the most effective types of that form of sound producer in existence, were not able to approach the sirens as regards efficiency for coast fog-signal purposes. If a reed instrument could be brought up to an equality with a siren in respect of sound power, it would probably be more economical than a siren in working. The question of trumpets received some special consideration at St. Catherine's, a new form of trumpet designed by Lord Rayleigh having been experimentally tried there. Lord Rayleigh had observed that with the conical trumpets of circular section usually employed there was a liability to some interference of the sound waves issuing from the mouth, caused by the difference in distance of the nearest and furthest parts of the mouth, whereby the waves were likely to get out of step and thus cause interference. He also pointed out that a good deal of sound was sent to the zenith from the mouth of circular section, which sound was certainly wasted. To remedy these defects, Lord Rayleigh's idea is to make the horizontal diameter at the mouth only half the length of the sound wave generated by the sounding instrument, and that the vertical diameter should be elongated to two wave-lengths or more, thus producing a mouth of elliptical section. The tendency for the waves issuing from the mouth to get out of step would thus be reduced to a minimum, and the narrowness of the mouth at top and bottom would offer but little scope for the sound to be projected upward or immediately downward. So far as the trials went, Mr. Price Edwards tells us that the effects produced were most encouraging, and it is now intended to set up this elliptical trumpet for practical trial at a fog-signal station. The mushroom form of trumpet for an all-round signal has been largely used for lightships. Instead of a long horizontal trumpet, or a vertical one with the head bent over (capable of being turned in any direction), the trumpet is fixed vertically with its mouth directed upward. Just above and in the centre of this open mouth is fixed an inverted cone, and the sound issuing from the trumpet strikes the curved sides of the cone and is reflected out with equal force all round the horizon. The trials made with this form of trumpet showed that it was well adapted for the purpose for which it had been designed.

But however powerful and characteristic the sound-producing instruments may be, the conditions of the atmosphere have very much to do with their effectiveness. An opposing wind, as is well known, shortens the range of penetration of the most powerful sound. An instance is given by Mr. Price Edwards when the sound of a siren was on one day heard for a distance of more than twenty miles, while on another day, with a little opposing wind and a noisy sea, the sound of the same instrument was not heard beyond a distance of one mile and a quarter. Fortunately, when sound signals are most needed, viz. in foggy weather, obstructive influences seldom occur; the air is generally still, the sea quiet, and a homogeneous condition as regards temperature and moisture exists, all of which conditions are favourable for the propagation of sound. It does not seem at all probable that the acoustic clouds of Prof. Tyndall are formed when fog prevails; indeed, they appear to want hot sun, causing evaporation from the sea surface, which produces areas of varying temperature and density. Two remarkable phenomena have been experienced in connection with the experiments at St. Catherine's for which no satisfactory explanation is yet forthcoming. In the one case it was found that at times there was a sort of hiatus in the passage of the sounds. Thus the observers on board the Trinity yacht *Irene* would be in full hearing of the sounds at a mile distance from the instruments. On proceeding out, the sounds would very soon fall away in strength until at a distance of between two and three miles they would be very faintly heard or lost altogether. Proceeding further out on the same line of bearing, the sounds would be gradually recovered, until a little beyond three miles they would again come into full hearing and be carried as loud and distinct sounds for a considerable distance. The question is, what becomes of the lost sound, and what is the influence which renders the area in question "a silent area"? The phenomenon apparently does not occur frequently, for very many times the observers went over the same space without experiencing any such hiatus of sound. Mr. Price Edwards suggests that to solve the question prolonged and continuous observation would be necessary in all parts of the sea area over which the sounds are projected—at the sea surface, on the deck of a vessel, and at varying distances upward by means of a captive balloon. It is of importance to determine, if possible, the cause of this intermission of audibility, in order that it may be prevented or guarded against when the sounds are being promulgated as official warnings to mariners.

The other noteworthy phenomenon which occurred at St. Catherine's and on previous occasions when sound signals have been tested by observation at sea were the aërial echoes. With a smooth sea and still atmosphere, the direct sounds from the sirens were immediately reinforced by powerful echoes from the sea. Mr. Price Edwards describes them as starting from a point on the horizon corresponding to the prolongation of the axis of the trumpet from which the sound proceeded, and with great rapidity spreading out over the sea expanse as though a scattered army of trumpeters in quick succession sounded their blasts from all parts of the horizon. Carefully timed, the echoes lasted at times for 30 seconds, or ten times as long as the original blast. Prof. Tyndall suggested that "the duration of the echo is a measure of the atmospheric depth from which it comes." If this be so, the length and strength of the echoes might afford a general indication of the relative penetrating power of the sounds of different instruments. With a disturbed atmosphere and an agitated sea surface, the echoes were very short or not heard at all. It is noteworthy that both the silent area and the aërial echoes occur chiefly in quiet weather, and that disturbance of air or sea appears to be antagonistic to their manifestation.

An important conclusion appears to have been arrived at in regard to the most suitable note pitch for the blasts of sirens or reed horns. In fog—as has been stated—the meteorological conditions are usually equable, and when such is the case a low-pitched note is found to be more effective than a high-pitched one; on the other hand, when air or sea is disturbed, the higher pitched notes seem to be rather less obstructed by the opposing influences, although the advantage is not very great. Having regard to the fact that the sounds are only required for use in foggy weather, a low-pitched note of about 98 vibrations per second (which is that which was heard plainly more than twenty miles away) is perhaps the best for the blasts of a siren fog signal. In this connection it should be mentioned that in order to obtain the best effect from an instrument it is essential that the note given by the sound producer should, if possible, be in unison with the proper note of the associated trumpet, otherwise the issuing sound is apt to be gruff and discordant.

SEA TEMPERATURE AND SHORE CLIMATE.

IN Mr. W. N. Shaw's paper "On the Seasonal Variation of Atmospheric Temperature in the British Isles" (*Proc.* Roy. Soc., vol. lxix., pp. 61-85), it is stated that it seems "probable that the ocean plays a paramount part in the causation of the second-order temperature effect which we experience in these islands. . . . Whether this variation of the temperature of the water which surrounds these islands is the cause of the atmospheric second-order variation, or whether it is only another effect of the same fundamental cause, does not appear, but in view of the fact that the marked second-order effect is not seen at Continental stations, it would seem not unlikely that the ocean temperature is the immediate cause of our second-order periodic temperature variation. . . . All the successive stages of temperature change are delayed by the effect of the sea. . . . The effect of the sea is to delay the seasons." Of course, it is a very old belief that the vicinity of the sea affects the temperature of a climate, moderating the heat of summer and the cold of winter, but the ideas on the subject have been of the usual vague popular character. What is curious is that it has taken so long to initiate some investigation designed to discover what may be the nature of the relationship between the temperature of the sea and that of the air over the adjacent land. Although the North Atlantic is the most frequented of the great oceans,

very little has thus far been accomplished in discussing its variations of temperature month by month throughout the year; indeed, the region between the 50th and 60th parallels, from our islands across to Labrador, has been almost wholly neglected. Some years ago, the Meteorological Office published mean results for four months; the Deutsche Seewarte has made a separate discussion of each of a number of 10°-squares; and the Copenhagen Institute annually supplies information for the far north, mainly on the routes from Denmark to Iceland and Greenland. These are the principal contributions to our knowledge of Atlantic sea temperature.

The Meteorological Council has now made a new departure in this matter. In connection with the publication of the monthly pilot chart of the North Atlantic and Mediterranean, the cooperation of the captains and officers of the Mercantile Marine has been enlisted to promptly supply daily records of sea temperature during their voyages. A gratifying response resulted in the return of more than 2500 ocean temperatures for the month of January last, and 2750 for February. This mass of valuable information has been grouped in spaces of 2° of latitude by 2° of longitude and means obtained. The results between 30° and 60° N. form the new feature of the pilot charts. Those for January appear on the April chart, and those for February on the May chart. In addition to the means, the variations from the averages of a long series of years are also shown, and lines are drawn separating the regions of excess and of defect. Generally speaking, in January the water was a degree or two colder than usual from Ireland down the face of the Bay to Portugal and thence westward across the Atlantic, while further north, from about the 20th meridian westward, the values were nearly all in excess. In February nearly the whole area was colder than during the preceding month, but compared with the February normals the region of excess was much more extensive than in January. The relatively cold water south-westward from the British Isles had, however, expanded westward to about 30° W. Close inshore the fall of temperature was very marked—off Eastbourne, for instance, it was 44° in January, an excess of 3°, while in February it was only 37°, a defect of 3°. Here we have the commencement of an investigation which, if continued, and improved as may be found necessary, should be fruitful of the most useful results. At present, with only the bare ocean results presented to us, it is not easy to explain what effect should be produced ashore. We know that the air temperature over the British Isles during last January was above the average to the extent of about 2°, while February was nearly 4° too cold, the coldest month for seven years. What part did the temperature of the ocean play in influencing the mildness of the one or the coldness of the other month?

With only these first charts before us, it is obviously impossible to form a just conception of the very complicated problem which requires solution. We must wait for a consecutive series of such charts and examine closely the variations disclosed month by month at sea and on land. It may be that the effect produced on our air temperature by the changes in that of the sea to the westward and south-westward is an indirect and not a direct result. The prevalence of winds from particular quarters for any length of time, and the cold or warm ocean surface currents which they set up, the movements of weather systems, &c., must be borne in mind. From the monthly pilot charts it is clear that at times the Gulf Stream fails to reach our shores owing to the existence of a stronger opposing flow. It has been advanced by Dr. Emil Lesshaft, in his paper "Der Einfluss der Wärmeschwankungen des Norwegischen Meeres auf die Luftcirkulation in Europa" (*Meteorologische Zeitschrift*, Band xvi.), that the paths followed by atmospheric disturbances are associated with the temperature of the sea water, and if that should prove to be the case we must consider first of all the temperature of the Atlantic and the march of weather systems, and then the effect the latter produce on our climate. The permanent Atlantic anticyclone maintains its position over a part of the ocean where there is only a slight variation of sea temperature, but its outer limits expand or contract enormously, at times stretching northward as far as Iceland and Greenland, especially in the month of May, when a broad belt of Arctic water flows southward beyond our western coasts. With our present knowledge we can only conjecture as to the causes of these variations, but the information about the sea temperature now becoming available may, perhaps, help us to arrive at a better idea of the forces at work. As the observations become more numerous, would it be possible to issue weekly results of sea temperature?

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ON Thursday next, June 5, the Sir John Cass Technical Institute, Aldgate, will be formally opened by the Right Hon. Lord Avebury, F.R.S.

WITH the object of creating interest in science teaching and nature-study in Southampton and the district, a conference will be held at the Hartley College, on June 14, together with an exhibition of home-made and other simple scientific apparatus. It is felt that much useful work is being done, the character of which is not generally known, and that teachers should be afforded an opportunity of comparing methods and becoming acquainted with that which the experience of others has proved to be of value. A preliminary meeting was held on May 10, when Dr. H. E. Armstrong, F.R.S., gave an address on the chief points to be borne in mind in early lessons in science. As he has often remarked before, science must not be taught so much on account of its matter as for training in scientific methods of work and reasoning. What is desired is that habits which characterise the true worker in science should become general habits, with the object of developing the practice of the best mental faculties.

THERE are many signs that the movement for reform in the teaching of mathematics will have a decided influence upon the scope and character of elementary geometry in schools. Several public examining bodies have lately had the subject under consideration, and changes in the direction of reform are likely to be instituted. The regulations just issued for the Oxford Local Examinations next year contain an announcement referring to the examinations in geometry which will have a very decided effect upon the scope and method of the subject in secondary schools. The notice reads as follows:—"Questions will be set so as to bring out as far as possible a knowledge of the principles of geometry, a smaller proportion than heretofore consisting of propositions as enunciated in Euclid. Any solution which shows an accurate method of geometrical reasoning will be accepted. No question will be set involving necessarily the use of angles greater than two right-angles. Geometrical proofs of the theorems in Book ii. will not be insisted upon." It is evident from this announcement, and the deliberations of other examining bodies and teachers, that Prof. Perry selected the right "psychological moment" for directing attention to the irrational ways of approaching geometry in schools and the need for recognition of work better adapted to modern needs. As both examiners and teachers are in general sympathy with his desire to get rid of artificiality in mathematics, we may expect that the time will come when geometry will not be commenced, as it is in many schools to-day, by learning Euclid's definitions, postulates and axioms and reading propositions, but by the intelligent use of compasses, protractor and scale.

IN introducing the Education Vote in the House of Commons on Monday, Sir John Gorst directed attention to some of the changes and developments which have taken place in the administration of the Board of Education. Schools of science and other secondary day schools inspected by the Board are to have block grants instead of payments by results of examination, the grants being assessed every three years. By this system, it is hoped that all inducement to cram will be removed. Both in the administration of the Parliamentary grant and in the inspection of schools the Board of Education will aim at encouraging originality and variety. The hope was expressed that the time would be far distant when those who had to administer the public funds of this country and to carry out the provisions of the Act with regard to secondary schools forgot the enormous danger of interfering to produce uniformity of system, and that they would give every encouragement to variety and independence. Referring to the Royal College of Science—one of the two Government colleges in London which are entirely under the management of the Board of Education, the other being the Royal College of Art—Sir John Gorst said:—"The vote for this school, which is a very advanced science school, has been increased in the present year by 1000*l.* for the purpose of enabling work to be continued—begun by Sir Norman Lockyer—respecting the relation of certain precedent phenomena in the sun observed through the spectroscope to the subsequent rainfall in India and Australia. No certain law has yet been established, but if the research is successful it will have enormous beneficial economic effects, both for India and Australia."